Genesis of the workshop

BACKGROUND

Aquaculture is a food production subsector receiving considerable attention for its ability to contribute to filling the growing fish supply gap, which is estimated to be of the order of 40 million tonnes by 2008 rising to 82 million tonnes in 2050 (FAO, 2010a). Aquaculture, however, cannot be practised everywhere; it requires a unique set of natural, social and economic resources. These resources must be wisely used if the development of the subsector is to be sustainable. Around the globe, the availability of areas that are suitable for aquaculture is becoming a major problem for the development and expansion of the sector. The need for sites with appropriate environmental characteristics and good water quality, the social aspects of interactions with other human activities, or conflicts over the use and appropriation of resources inland and along coastal zones are constraints to be considered in the monitoring of existing aquaculture facilities and in the decisions to set up new facilities. Site selection and carrying capacity are among the most important issues for the success of aquaculture, and they need to be carried out in accordance with sustainability, resilience and best practice guidelines.

Although technical guidelines for the FAO Code of Conduct for Responsible Fisheries and the ecosystem approach to aquaculture (EAA) are both available from FAO as reference documents (FAO, 1995; FAO, 2010b), these may require specific consideration for use in different countries and regions, and more explicit guidelines will need to be developed for aquaculture site selection and carrying capacity estimates in inland and coastal aquaculture (Aguilar-Manjarrez, Kapetsky and Soto, 2010).

With the above considerations in mind, the Aquaculture Branch at FAO asked the Sustainable Aquaculture Group at the Institute of Aquaculture, University of Stirling, the United Kingdom of Great Britain and Northern Ireland, to organize a workshop and global review on "Guidelines for Aquaculture Site Selection and Carrying Capacity for Inland and Coastal Aquaculture".

OBJECTIVES

- To prepare global and regional reviews on site selection and carrying capacity encompassing inland aquaculture and coastal aquaculture; to be presented and discussed at the workshop.
- To prepare draft guidelines, including summaries of the key findings and recommendations, for aquaculture site selection and carrying capacity within an ecosystem perspective based on the reviews and the workshop discussions.

IMPLEMENTATION AND PARTICIPATON

The workshop took place from 6–8 December 2010 at the Stirling Management Centre in the University of Stirling, the United Kingdom of Great Britain and Northern Ireland (www.aqua.stir.ac.uk/GISAP/FAO_workshop). The workshop was attended by 20 internationally recognized experts, including two staff members of FAO, and covered different core topics and represented different regions of the world. This was supplemented by written input by the experts for the reviews on "Environmental Impact, Site Selection and Carrying Capacity Estimation for Small-scale Aquaculture in Asia" and on "Guidelines for Aquaculture Site Selection and Carrying Capacity for Inland and Coastal Aquaculture in Mid- and Northern Europe", who were unable to attend the workshop. Expertise within this group included the academic, regulatory and consultative sectors of the industry, thus giving a wide perspective of views on the core topics. The list of participants is provided in Annex 2.

Workshop development and findings

Following a welcome to participants and a general introduction to the agenda and format of the event, the workshop consisted of plenary presentations and brainstorming sessions on a wide range of topics (see Agenda, Annex 1). The scene was set for the workshop through three introductory reviews presentations.

Trevor Telfer summarized the key concepts of the first global review entitled "Carrying Capacities and Site Selection within the Ecosystem Approach to Aquaculture", and highlighted the baseline considerations and also some issues to be resolved for implementation in the aquatic environment. These were discussed in relation to the EAA (FAO, 2010b) and methods of its application in terms of scale, legislation and policy, and implementation. Examples were given from Ireland, the People's Republic of China, the Socialist Republic of Viet Nam and the United Kingdom of Great Britain and Northern Ireland. The importance of decision support systems and incorporation of dynamic and spatial models for their implementation for the different concepts of carrying capacity was highlighted. Based upon this, and throughout the workshop, much attention was given to establishing comprehensive and robust definitions of carrying capacity and its relationship with site selection, with the discussions focusing on the four "pillars" defined by McKindsey *et al.* (2006): physical, production, ecological and social.

Doris Soto presented an overview of the "Ecosystem Approach to Aquaculture and Its Relation to Site Selection and Carrying Capacity", which helped place all the following presentations and discussions in the context of EAA implementation. The three key principles of the EAA, agreed during an FAO Expert Workshop in 2007 (Soto, Aguilar-Manjarrez and Hishamunda, 2008; FAO, 2010b), are:

- Principle 1: Aquaculture development and management should take account of the full range of ecosystem functions and services, and should not threaten the sustained delivery of these to society.
- Principle 2: Aquaculture should improve human well-being and equity for all relevant stakeholders.
- Principle 3: Aquaculture should be developed in the context of other sectors, policies and goals.

José Aguilar-Manjarrez gave an overview of "Spatial Modelling for the Ecosystem Approach to Aquaculture and Its Relation to Site Selection and Carrying Capacity". He noted that spatial tools can support decision-making and modelling within and among all boundaries associated with aquaculture development and management, although it is difficult to prescribe the models to use for site selection and zoning (e.g. hydrodynamic models) because the choice of model depends entirely on the specific issue, study area, scale and research objectives. An ideal scenario for site selection and zoning is one in which a suite of models is developed and computed. It is also important to remember that the better the background data, the more trustworthy the output of the modelling will be.

After the introductory reviews, six additional global review presentations and associated discussion sessions followed, which focused on wide-ranging environmental, socio-economic, legal, spatial and hydrodynamic aspects of site selection and carrying capacity.

João Gomes Ferreira outlined the "Key Drivers and Issues Surrounding Carrying Capacity and Site Selection, with Emphasis on Environmental Components". He noted that virtual technologies of all kinds have a pivotal role in addressing carrying capacity and site selection, although such models do need to be more production oriented. The connectivity between environment and socio-economic aspects also requires further investigation and integration, and there is a need to ensure that production in developing countries should not translate into negative environmental externalities.

Barry Costa-Pierce discussed "Carrying Capacity Tools for Use in the Implementation of an Ecosystems Approach to Aquaculture", with emphasis on the framework for defining the four different types of carrying capacities for shellfish and cage finfish. He outlined new examples of potential decision-making tools for the spatial planning and the ecosystem-based management of aquaculture. He also commented that the ability to estimate different types of carrying capacities is a valuable tool for decision-makers and the public when assessing the impact of development and expansion of aquaculture operations, and can be of use to help develop more sophisticated spatial plans and multiple uses of aquatic space that include aquaculture. The development of more refined and inclusive carrying capacity frameworks and models will help to organize the many available indicators and metrics and allow improved tracking of communications about, and sectoral progress towards, an EAA.

David Little described the "Socio-economic Factors affecting Aquaculture Site Selection and Carrying Capacity". He noted that the location of aquaculture activities has historically been based on a combination on local demand and agro-ecology, with global demand and deteriorating capture fishery stocks having an increasing influence. External interventions to stimulate interest in aquaculture in developing countries have often been driven by geographical and environmental considerations with little regard for other key criteria for successful aquaculture, often resulting in limited development and sustainability. Aquaculture has the potential to cause significant social and economic impacts through the use of chemicals, wastes expelled and stock migration, affecting a range of stakeholders. Similarly, employment along the value chains can bring benefits to people who are not directly involved in farming. He considered that the focus in development programmes should be placed on identifying and responding to local factors rather than allowing top-down, external factors to dominate. Community stakeholder engagement needs to be strengthened, with more rigorous application of cost–benefit analysis and a broad understanding of the social and ecosystem services that are part of aquaculture.

Jorge Bermúdez discussed the "Legal and Policy Components of the Application of the Ecosystem Approach to Aquaculture to Site Selection and Carrying Capacity". He noted that planning decisions should be proactive rather than reactive, recognizing that most major aquaculture concerns have regional or cumulative impacts. Analysis of the legal framework has three major conclusions. First, that from an environmental perspective, carrying capacity allows identification and categorization of appropriate sites. It is important to overcome the site-by-site regulation process. Decisions on site selection are made on an individual basis in response to applications for tenure. This mechanism ignores the fact that many of the major concerns involve regional or cumulative impacts. Second, a range of factors must be considered in order to improve human well-being and equity, and aquaculture carrying capacity is an important aspect of them, although regulators may be unsure of what impacts aquaculture will cause. Third, the objective of the carrying capacity process is to provide appropriate knowledge to the administrative authorities, which may have differing levels of authority. From the site selection perspective, acceptability of aquaculture is linked to stakeholder participation, and sophisticated policy-making is required in order to promote industrial activity and to legitimize the process.

James McDaid Kapetsky described the review entitled "From Estimating Global Potential for Aquaculture to Selecting Farm Sites: Perspectives on Spatial Approaches and Trends". He considered that the spatial domain of site selection and carrying capacity extends from global to local, and suggested that estimating potential (capability for aquaculture development) and zoning (partitioning space for aquaculture) should be added to site selection and carrying capacity. He noted the trend for "all-in-one" applications that include multiple objects (species at different trophic levels and varied culture systems) and multiple functions (site selection, carrying capacity, monitoring for management, including legal aspects), taking into account ecosystem level spatial boundaries, involving active participation or scrutiny by the public, and producing outputs that are highly relevant to managers and aquaculture practitioners. The temporal and spatial scale of such applications needs to be extended and implemented early in aquaculture development planning in a precautionary way and at the national level even where there is less certainty in the results. The main bottlenecks to implementing broad scale spatial analyses are lack of data of appropriate resolution and variety of input data for models, as well as the apparent problem of disseminating the techniques and building the capacities to utilize them.

Arnoldo Valle-Levinson outlined "Some Basic Hydrodynamic Concepts to Be Considered for Coastal Aquaculture". Sustainable coastal aquaculture requires a combination of field measurements and numerical model implementation, calibration and validation. Basic forcing agents that need to be considered in a study are freshwater discharge (and its seasonal variability), atmospheric forcing (with its synoptic and seasonal variability), tidal forcing (with semidiurnal, fortnightly and seasonal variability), bathymetric effects, and earth's rotation effects. These forcing agents determine temporal and spatial variations of relevant parameters, such as hydrography, dissolved oxygen and nutrients. A three-stage process was proposed based on simple criteria for the location of a fish cage, or fish cage cluster, as well as a simple criterion based on the tidal excursion at a given aquaculture site for optimal individual fish cage or fish cage cluster separation. This allows determination of "ellipses of influence" for a given cluster or cage, which indicates the potential area in the body of water that may be influenced by suspended and dissolved materials associated with aquaculture activities.

The workshop devoted further sessions to the presentation and associated discussions of ten regional reviews with a specific geographic focus, covering the major continents and ranging from intensive to extensive implementations of carrying capacity and current regulation in different countries.

Ioannis Karakassis reviewed "Environmental Interactions and Initiatives on Site Selection and Carrying Capacity Estimation for Fish Farming in the Mediterranean". He outlined the extensive consultative processes for the area, and the role that FAO and the General Fisheries Commission for the Mediterranean have taken to assist cooperation for the development of aquaculture and to enhance the dialogue among Mediterranean States and stakeholders regarding three main issues, i.e. site selection and carrying capacity, sustainability indicators and marketing of aquaculture products.

Anne-Katrine Lundebye Haldorsen considered "Aquaculture Site Selection and Carrying Capacity for Inland and Coastal Aquaculture in Northern Europe", giving specific emphasis to the integration of aquaculture approaches in the Kingdom of Norway, currently the largest aquaculture producing country in Europe, with regulation and governance. She noted that the Modelling-Ongrowing fish farms-Monitoring (MOM) model in use in Scandinavia is primarily meant to estimate the holding capacity of new sites for fish farming, but that it may also be used to assess the environmental consequences of changes in production on farms already in operation. It was recommended that, in order to expand aquaculture in European coastal waterbodies, farming techniques should be developed to reduce environmental

impacts. In the Kingdom of Norway, this involves combating the problem of salmon lice and reducing the number of escapees from salmon farms. An increased production from inland aquaculture is most likely achievable by intensification at existing sites and further development of recirculation aquaculture systems to reduce water and energy consumption and to reduce nutrient emission to the environment.

Sherif Sadek reviewed "Aquaculture Site Selection and Carrying Capacity Estimates for Inland and Coastal Aquaculture in the Arab Republic of Egypt". He described how carrying capacity management status can assist and protect the durability of this important industry. The effect of rapid expansion of the industry on environmental sustainability was outlined along with such issues as environmental pressure and pollution caused by agricultural and industrial development, all of which affect aquaculture carrying capacity. He emphasized the need for spatial management through appropriate zoning to control water quality and to minimize effects on communities.

Ruby Asmah summarized "Aquaculture Site Selection and Carrying Capacity Estimates for Inland and Coastal Aquaculture in West Africa", focusing on the state of aquaculture development in the West African region, current criteria and approaches for site selection within the region, considering current legislation, regulations and actual compliance, and finally describing the main carrying capacity and site selection issues, gaps in information and local needs. Current environmental law was summarized as was the use of models and decision support tools in the subregion, noting that current site selection procedures are based on individual site assessment, which could be lengthy and subjective. Although the environmental and social impacts of a single farm might seem unimportant, more attention must be paid to the potentially cumulative ecosystem effects of groups of farms at particular sites. She proposed that the first step needed to bring aquaculture site selection in the subregion in line with the EAA principles is to create awareness of these principles, train stakeholders and relevant regulatory bodies on the requirements of these principles, and equip relevant institutions with the necessary tools to be able to implement them.

Martin De Wit considered "Aquaculture in Southern Africa with Special Reference to Site Selection and Carrying Capacity Issues". He identified a series of obstacles to sustainable development of aquaculture in the region, including lack of start-up capital, that planned site selection is expensive and time consuming, the need to engage with the EAA, the impacts of introduced trout on endemic species, the impact of farm effluents on carrying capacity, the cost of accurate risk assessments, and that the culture of indigenous species may be used as a front for the sale of wild-poached products. All of these complex environmental and societal influences have a strong effect on estimates of carrying capacity and site selection.

Changbo Zhu described "Aquaculture Site Selection and Carrying Capacity Management in the People's Republic of China". He emphasized the significant impact that fisheries and aquaculture have had on Chinese living standards and food security. As the largest aquatic food producer in the world, the People's Republic of China has already exploited most of its suitable waterbodies and land. Consequently, factors relevant to aquaculture site selection in the People's Republic of China include functional zoning schemes for local land and water areas, water and other environmental quality requirements, influence on the local environment, and the influence on community welfare. Local issues affecting sustainable development of aquaculture include farming at the limits of carrying capacity, environmental pressure and deterioration caused by industrialization, rapid expansion of inland freshwater shrimp farming, and the predicament of aquaculture-related law enforcement. The continuous increase in fed aquaculture may lead to a reduction in net food production and increasing environmental pressures. The current bottlenecks limiting reasonable aquaculture site selection and carrying capacity management in the

People's Republic of China relate to water area zoning scheme enforcement and the lack of effective monitoring and legislation on aquaculture effluent discharge. Optimization of sustainable aquaculture in the People's Republic of China depends upon the revision of these factors as well as the revision of product price to include the environmental cost.

Patrick White provided a review of "Environmental Impact, Site Selection and Carrying Capacity Estimation for Small-scale Aquaculture in Asia". He highlighted the continuing importance of aquaculture in Asia to provide livelihoods, food security and export earning power, but at the same time highlighted the problems with the environmental impact from the large numbers of small-scale producers and the difficulties in planning and management of further development. He identified a number of difficulties for the sector and emphasized a need for greatly improved sectoral planning, to include strategic aspects, zoning, and use of clustering of activities in aquaculture parks. The use of appropriate modelling tools was noted, mainly aimed at improved management systems, clusters, and wider producer networks of clusters, for which national aquaculture agencies should be encouraged to provide extension and training support.

Stephen Cross gave an overview of "Carrying Capacity and Site Selection Tools for Use in the Implementation of an Ecosystem-based Approach to Aquaculture in Canada: a Case Study". He discussed current practice and carrying capacity issues in coastal British Columbia, Canada, illustrating how this jurisdiction currently manages aquaculture site selection and operations, and how ongoing changes to its overarching policy and regulatory processes relate to the development of an EAA. Environmentally, carrying capacity issues are addressed using a combination of geographic information systems (GIS)-based resource modelling and spatial separation guidelines, waste dispersion models such as DEPOMOD to run simulations of organic waste dispersion/accumulation, and performance-based monitoring using physical-chemical surrogates of biological response to ecosystem stress. The environmental tools for carrying capacity and site selection are not applied equally to all aquaculture culture systems, and deficiencies in the approach are recognized as significant gaps to forming a comprehensive and defensive EAA. Socially, British Columbia aquaculture competes with a variety of coastal activities, and new initiatives to assess social-ecological performance, in the form of a sustainability report, have been introduced, holding the promise of communicating the positive attributes of an EAA.

Philip Scott reviewed "Regional and National Factors Relevant to Site Selection for Aquaculture in the Federative Republic of Brazil", and illustrated how aquaculture and fisheries production had grown over the last decade to 1.24 million tonnes in 2009. Aquaculture, specifically, grew by 49 percent between 2003 and 2009, although this growth has taken place in spite of many drawbacks and has been strongly based on private sector initiatives. Initial difficulties faced by aquaculturists in the Federative Republic of Brazil included the lack of specific environmental legislation, existence of costly licence fees, and public prices beyond the means of small producers. In contrast to terrestrial agricultural activities, there have also been difficulties in handling the complexity of information necessary for the licensing process, a lengthy consultation process, and generally poor access to "aqua" credit. Consequently, there has been little if any stimulus for investment in aquaculture, much less good production practices, this being especially the case for small farmers. Nonetheless, carrying capacity models have recently been used for freshwater aquaculture, especially in large reservoirs whose primary function is hydroelectric generation. The trade-off between "environmental services" of the many relatively recently developed artificial ecosystems in the context of an EEA is difficult. GIS has been used to support several marine aquaculture projects.

Alejandro Clément reviewed the "Ecosystem Approach and Interactions of Aquaculture Activities in Southern Chile". He illustrated the interactions among different aquaculture activities in the coastal zone and inland sea in southern Chile. Particular emphasis was given to negative ecological events observed during the last decade. He considered the need for robust marine surveys and models for environmental prediction and decision support to site selection and zoning, noting that only when these were available and reliable would it be possible to estimate the relative amounts and inputs of "new production" from aquaculture with those natural fluxes in the sea.

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Workshop recommendations and the potential role of FAO

RECOMMENDATIONS

Presentations at the workshop demonstrated how different categories of carrying capacity may be used either in isolation or in combination to address site selection and sustainability of aquaculture.

Participants agreed that estimation of carrying capacity for aquaculture development almost always requires a multifaceted approach, which is covered by at least four categories – physical, production, ecological and social.

Physical carrying capacity is best considered as a primary and broader site selection criterion, while the remaining categories determine the real and effective carrying capacity, with the possible extension to include economic carrying capacity.

It was also agreed that participatory consultation with a full stakeholder range was essential and that such consultation should include consideration of acceptable change.

It was agreed that carrying capacity estimates should be iterative and revisited beyond any initial development, to allow for re-evaluation of sites periodically and to apply corrective measures when needed.

It was recommended that FAO should promote the use of these components in addressing carrying capacity within the framework of the EAA.

There should be a greater awareness of the range of modelling tools to assist carrying capacity estimation and support decision, as well as training activities in their use.

It was also noted how GIS and associated spatial tools can contribute to holistic modelling of carrying capacity to support and facilitate the implementation of the EAA. However, an enabling environment is crucial to adopt the use of spatial tools to support the EAA, and FAO can contribute by promoting their use and supporting more extensive training for end users.

There is a continuing need to gauge capacities (human resources, infrastructure, finances) at the national and/or regional level to implement the use of appropriate modelling and spatial tools in support of the EAA so that capacity-building initiatives can be matched to existing capabilities.

It was agreed that training needs should be met using appropriate modes of delivery to include both face-to-face training and online workshops and seminars.

Participants agreed that some guidance on how to approach estimates of carrying capacity and site selection are needed. Implementation of a more comprehensive and holistic approach to carrying capacity estimation and site selection needs to be encouraged by increasing awareness of benefits.

As a practical first step, development of a set of guidelines was recommended to illustrate the approach and uses of modelling to address carrying capacity, particularly in relation to the EAA, and using a selection of case studies from different regions, environments, species and culture systems.

THE POTENTIAL ROLE OF FAO AND THE WAY FORWARD

FAO should continue to assist the aquaculture sector to grow in a sustainable manner, taking into account food security on the one hand while robustly addressing issues of site selection and carrying capacity to ensure sustainability.

Under the umbrella of the EAA, which has already been effectively promoted by FAO, the organization should strongly promulgate the concepts of carrying capacity

for proper siting of aquaculture developments as proposed by this workshop.

FAO is in a position to provide strong worldwide leadership for more holistic aquaculture project development, which must comprise the full range of components identified under the EAA and include the various facets of carrying capacity as defined in these proceedings.

FAO could consider how to embed best practice across the sector by promoting and providing the training in the concepts and use of support tools that will be essential to extending the EAA and carrying capacity concepts worldwide.

Key outputs from this workshop are these proceedings, which includes a synthesis of the current workshop experts' position on "Carrying Capacities and Site Selection within the Ecosystem Approach to Aquaculture".This document will then form the basis for the guidelines on implementation of carrying capacity and site selection for inland and coastal aquaculture, within the EAA, to be published by FAO.

Subsequently, the wide dissemination of the present report and the accompanying guidelines will be key to effective and more widespread adoption by policy-makers and stakeholders worldwide.

Annex 1 – Agenda

Expert Workshop on Site Selection and Carrying Capacities for Inland and Coastal Aquaculture
Institute of Aquaculture, University of Stirling, the United Kingdom of Great Britain and Northern Ireland
5–8 December 2010

DATE	TIME	ACTIVITY
5–12–10		Arrival of participants
6–12–10	08:30	Coffee
	09:00	Welcome and introduction to the workshop – Lindsay G. Ross
	09:30	Carrying capacities and site selection within the ecosystem approach to aquaculture – a global review for a scene-setting discussion – Trevor C. Telfer
	10:00	Ecosystem approach to aquaculture and its relation to site selection and carrying capacity – Doris Soto
	10:30	Spatial modelling for the ecosystem approach to aquaculture and its relation to site selection and carrying capacity – José Aguilar-Manjarrez
	11:00	Coffee
	11:30	Discussion: Agreeing on a basis for carrying capacity in the aquaculture context
	12:00	Key drivers and issues surrounding carrying capacity and site selection, with emphasis on environmental components – João Gomes Ferreira Laudemira Ramos and Barry A. Costa-Pierce
	12:30	Carrying capacity tools for use in the implementation of an ecosystems approach to aquaculture – Carrie J. Byron and Barry A. Costa-Pierce
	13:00	Lunch
	14:00	Socio-economic factors affecting aquaculture site selection and carrying capacity – David Little
	14:30	Legal and policy components of the application of the ecosystem approach to aquaculture to site selection and carrying capacity – Jorge Bermúdez
	15:00	From estimating global potential for aquaculture to selecting farm sites: perspectives on spatial approaches and trends – James McDaid Kapetsky and José Aguilar-Manjarrez
	15:30	Coffee
	16:00	Some basic hydrodynamic concepts to be considered for coastal aquaculture – Arnoldo Valle-Levinson
	16:30	Discussion and round-up of the day's presentations

DATE	TIME	ACTIVITY
7–12–10	08:30	Coffee
	09:00	Environmental interactions and initiatives on site selection and carrying capacity estimation for fish farming in the Mediterranean – Ioannis Karakassis
	09:30	Aquaculture site selection and carrying capacity for inland and coastal aquaculture in Northern Europe – Anne-Katrine Lundebye Haldorsen
	10:00	Aquaculture site selection and carrying capacity estimates for inland and coastal aquaculture in the Arab Republic of Egypt – Sherif Sadek
	10:30	Coffee
	11:00	Aquaculture site selection and carrying capacity estimates for inland and coastal aquaculture in West Africa – Ruby Asmah
	11:30	Aquaculture in Southern Africa with special reference to site selection and carrying capacity issues – Martin De Wit
	12:00	Aquaculture site selection and carrying capacity management in the People's Republic of China – Changbo Zhu and Shuanglin Dong
	12:30	Environmental impact, site selection and carrying capacity estimation for small-scale aquaculture in Asia – Patrick G. White, Michael Phillips and Malcolm Beveridge
	13:00	Lunch
	14:00	Carrying capacity and site selection tools for use in the implementation of an ecosystem-based approach to aquaculture in Canada: a case study – Stephen F. Cross
	14:30	Regional and national factors relevant to site selection for aquaculture in the Federative Republic of Brazil – Philip C. Scott
	15:00	Ecosystem approach and interactions of aquaculture activities in southern Chile – Alejandro Clément
	15:30	Coffee
	16:00	Working group discussions on: inputs, process and implementation
	19:30	Dinner – with guest Professor Brian Austin (Director of the Institute of Aquaculture) and Professor Ian Simpson (Deputy Principal Research and Head of the School of Natural Science)
8–12–10	08:30	Coffee
	09:00	Plenary discussion of definitions of carrying capacity and interactions with site selection
	11:00	Coffee
	11:30	Presentations of deliberations of working groups
	13:00	Lunch
	14:00	Presentation of draft outline for proceedings and guidelines and concluding discussions
	15:30	Closure of the workshop

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